WORKING
PAPER

Going Beyond Test Scores

Evaluating Charter School Impact on Educational Attainment in Chicago and Florida

KEVIN BOOKER, MATHEMATICA POLICY RESEARCH, INC.
TIM R. SASS, FLORIDA STATE UNIVERSITY
BRIAN GILL, MATHEMATICA POLICY RESEARCH, INC.
RON ZIMMER, RAND

WR-610-BMG

August 2008

Prepared for the Bill and Melinda Gates Foundation, the Joyce Foundation, the Smith Richardson Foundation, the Stranahan Foundation, and the William Penn Foundation

EDUCATION

Summary

Unlike past charter school studies, which focus on student achievement, we analyze the relationship between charter high school attendance and educational attainment. We find that charter high schools in Florida and in Chicago have substantial positive effects on both high school completion and college attendance. Controlling for observed student characteristics and test scores, univariate probit estimates indicate that among students who attended a charter middle school, those who went on to attend a charter high school were 7 to 15 percentage points more likely to earn a standard diploma than students who transitioned to a traditional public high school. Similarly, those attending a charter high school were 8 to 10 percentage points more likely to attend college. Using the proximity of charters and other types of high schools as exogenous instruments for charter high school attendance, we find even stronger effects in bivariate probit models of charter attendance and educational attainment. While large, our estimates are in line with previous studies of the impact of Catholic high schools on educational attainment.

---

*This research was funded by generous grants from the Bill and Melinda Gates Foundation, the Joyce Foundation, the Smith Richardson Foundation, the Stranahan Foundation, and the William Penn Foundation. We also wish to thank Phil Gleason, Elaine Allensworth, David Figlio, Dan Goldhaber, Eric Isenberg, and John Witte for valuable comments. The authors are solely responsible for the analysis and conclusions in the paper, however.

I. Introduction

Charter schools have become one of the most widely used alternatives to traditional public schools and have received considerable attention among education researchers as a result. Most of the extant analyses focus on the achievement effects of charter attendance, using either student-level panel data sets (Ballou et al. (2006), Bifulco and Ladd (2006), Booker et al. (2007), Hanuschek et al. (2005), Sass (2006), Solman, Paark and Garcia (2001), Zimmer and Buddin (2006)) or random assignment via lotteries (Hoxby and Murarka (2007), Hoxby and Rockoff (2004)) to control for selection into charter schools. Beyond achievement effects, however, there has been only limited analysis of the impacts of charters on the students who attend them. Solmon and Goldschmidt (2004) study the relationship between charter attendance and student retention/mobility while Imberman (2007) considers the effect of charter schools on student behavior.

In this paper we seek to determine the effects of charter high school attendance on educational attainment. In particular, do charter high schools increase the likelihood a student will complete high school and attend college? Given the positive association between educational attainment and a variety of economic and social outcomes, an affirmative answer could have significant implications for the value of school choice.

Determining the influence of charter school attendance on educational attainment is not easy, however, due to the inherent selection problem associated with students who attend charter high schools rather than traditional public high schools. Students who select into charter high schools may be different in ways that are not readily observable from those who choose to attend traditional public high schools. The fact that the charter students and their parents actively sought out an alternative to traditional public schools suggests the students may be more

motivated or their parents may be more involved in their children's education than are the families of traditional public school attendees. Since these traits are not readily observable, they would be falsely attributed to the charter high school and thus bias the estimated impact of charter high schools on educational attainment.

The two methods of dealing with selection bias in achievement studies, student "fixed effects," and random assignment via lotteries, are not practical in the high school context. The fixed effects approach is applicable to situations where there are repeated outcome measures over time for a single student. Assuming that student/family characteristics are constant over time, the variation in test scores for students who move between traditional public schools and charters can be used to infer the differential impacts of the two types of schools on student achievement while holding student/family characteristics constant. However, since only a single outcome is observed in the present context (e.g., a student receives a high school diploma or not), the fixed effects approach cannot be used. Application of the lottery method is problematic in the high school context as well. In the student achievement literature, oversubscribed charter schools that accept students based on a lottery system provide a venue for a classic random assignment experiment. Students who apply and are accepted for admission ("lotteried in students") can be compared to students who apply but lose out and must attend a traditional public school ("lotteried out" students). Unfortunately, there is little or no reliable information available on oversubscribed charter high schools that use lotteries to determine admission, making this approach infeasible in the present context.

We employ three methods to deal with the selection bias problem. The first strategy is to control for any observable differences in charter and non-charter high school students prior to high school entry. These include factors such as race/ethnicity, gender, disability status and

family income. Most important, however, is the use of eighth-grade test scores to capture differences in student ability and past educational inputs received prior to high school. Second, we focus on students who attended a charter school in grade 8, just prior to beginning high school. If there are unmeasured student/family characteristics that lead to the selection of charter high schools, these unmeasured characteristics ought to also lead to the choice of a charter school at the middle school level. Thus comparisons of traditional public school 8th graders and charter school 8th graders would likely be biased due to self-selection. The unobserved student/family characteristics should be relatively constant within the subgroup of charter 8th graders, however. This is the same approach that Altonji et al. (2005) take in the context of evaluating Catholic high schools. Third, like Neal (1997) and Grogger and Neal (2000) do in their analyses of Catholic high schools, we exploit variation in the location of charter high schools to construct instruments for the choice of attending a charter high school. For many charter middle school students, attending a charter high school may be infeasible due to the unavailability of a charter high school within a reasonable distance.

We find that charter high schools in Florida and in Chicago have substantial positive effects on both high school completion and college attendance. Controlling for observed student characteristics and test scores, univariate probit estimates indicate that among students who attended a charter middle school, those who went on to attend a charter high school were 7 to 15 percentage points more likely to earn a standard diploma than students who transitioned to a traditional public high school. Similarly, those attending a charter high school were 8 to 10 percentage points more likely to attend college. The results from bivariate probit models of charter high school attendance and educational attainment are even stronger. While large, our

estimates are in line with previous studies, which find that Catholic high school attendance boosts high school graduation probabilities and college attendance rates by 10 to 18 percent.[1]

II. Data

The data required to analyze the impact of charter high schools on educational attainment are substantial. One must have data on school type and educational outcomes of individual students prior to high school, individual-level high school attendance and exit information as well as data on college attendance after high school. On top of this, the jurisdiction studied must have a sufficient enrollment of students in charter high schools to provide reliable results. The areas we analyze, the state of Florida and the city of Chicago, are two of perhaps a handful of places where all of the necessary data elements are currently in place.

A. Florida

The Florida data come from a variety of sources. The primary source for student-level information is the Florida Department of Education's K-20 Education Data Warehouse (K-20 EDW), an integrated longitudinal database covering all public school students and teachers in the state of Florida. The K-20 EDW includes detailed enrollment, demographic and program

---

[1] Sander and Krautmann (1995), using data from 1980 High School and Beyond surveys, find Catholic high school attendance is associated with a 10 percentage point reduction in the high school dropout rate. Evans and Schwab (1995), who also used the 1980 High School and Beyond data, estimate Catholic high school attendance raises the probability of high school graduation 12-13 percentage points and increases the likelihood of college attendance by 11-13 percentage points. Based on NLSY79 data, Neal (1997) finds Catholic high school attendance boosts the probability of graduating from high school 16 percentage points for urban minorities and 10 percentage points for whites in urban areas. Grogger and Neal (2000), using NELS data from 1988-1994, find even larger effects. They estimate that Catholic high school attendance is associated with an 18 percentage point increase in expected graduation rates for urban minorities and a 17 percentage point increase in the likelihood of college attendance for all minority students. As a further check on the reasonableness of our results, we estimated the impact of charter high school attendance on 10th grade achievement test scores. The results, reported in Appendix Tables A4 and A5, yield generally insignificant achievement effects in Florida and small positive effects on the order of 0.15 standard deviations in Chicago.

participation information for each student, as well as their reading and math achievement test scores.

As the name implies, the K-20 EDW includes student records for both K-12 public school students and students enrolled in community colleges or four-year public universities in Florida. The K-20 EDW also contains information on the Florida Resident Assistance Grant (FRAG), a grant available to Florida residents who attend private colleges and universities in Florida. This effectively allows one to track students who attend private institutions of higher education within Florida. Data from the National Student Clearinghouse, a national database that includes enrollment data on 3,300 colleges from throughout the United States, is used to track college attendance outside the state of Florida as well as any private college enrollment in Florida not picked up by the FRAG data.[2]

The identity and location of schools is determined by the Master School ID files (for public K-12 schools) and the Non-Public Master Files (for private schools) maintained by the Florida Department of Education. Grade offerings are determined by enrollment in the October membership survey and by the school grade configuration information in the relevant school ID file.

High school graduation is determined by withdrawal information and student award data from the K-20 EDW. Only students who receive a standard high school diploma are considered to be high school graduates. Students earning a GED or special-education diploma are counted as not graduating. Similarly, students who withdrew with no intention of returning or exited for other reasons such as non-attendance, court action, joining the military, marriage, pregnancy, and medical problems, but did not later graduate, are counted as not graduating. Students who died

[2] Information on the National Student Clearinghouse is available at www.studentclearinghouse.org.

while in school are removed from the sample. It is not possible to directly determine the graduation status of students who leave the Florida public school system to attend a home-schooling program, to enroll in a private school or who move out of state. Similarly, some students leave the public school system for unknown reasons. Students whose graduation status is unknown are more likely to have lower 8th grade test scores and possess other characteristics associated with a reduced likelihood of graduation.[3] They also are more likely to initially attend a traditional high school rather than a charter high school. To avoid possible bias associated with differential sample attrition, we impute the graduation status for those students whose graduation outcome is unknown, based on predicted values from a regression model of graduation.[4] Since we can track college attendance both within and outside of Florida, no imputation is necessary for the college attendance variable. Any individual who does not show up as enrolled in a two-year or four-year college or university is classified as a non-attendee.

The available data cover four cohorts of 8th grade students. Statewide achievement testing for 8th grade students began in the 1997/98 school year, so the first cohort in the sample are students who attended 8th grade in 1997/98.[5] The last available year of student data is 2004/05. Given that high school completion typically takes four years, this means the last cohort that can be tracked through high school are students who attended grade 8 in 2000/01.

---

[3] Based on the information in Table 2, sample attrition in Florida is 22 percent for charter-to-traditional students and only 15 percent for charter-to-charter students. In Chicago the numbers are reversed: 13 percent attrition from the charter-to-traditional sample and 20 percent from the charter-to-charter sample.

[4] Imputation was done with the uvis procedure in Stata. All variables reported in Table 3, except for the charter high school attendance variable, were used to predict graduation. If students whose graduation status is unknown are removed from the sample (rather than having their graduation status imputed), we obtain similar, though somewhat larger estimated effects of charter attendance on high school graduation. See Tables 10 and 11.

[5] Data on limited English proficiency (LEP) and special education program participation begins in 1998/99 and is thus not available for the first 8th-grade cohort. For these students we use their LEP and special education status in ninth grade.

B. Chicago

The Chicago data were obtained from the Chicago Public Schools Department of Postsecondary Education. The data include all students who attended charter schools in Chicago in eighth grade, whether they attended a charter high school or traditional public high school. The data cover five cohorts of 8th grade students, students who began 8th grade from the 1997/98 school year through the 2001/02 school year.

The data include student records for grades 8-12 from the Chicago Public Schools data system, with 8th grade ITBS math and reading scaled scores and information on student gender, race/ethnicity, bilingual status, free or reduced-price lunch status, and special education status. The data are also linked to the National Student Clearinghouse, which tracks college attendance for students who graduated from the Chicago Public School system.

High school graduation is determined by withdrawal information from the Chicago Public School data. Only students who receive a standard high school diploma are considered to be high school graduates. For students who leave the Chicago public school system, we impute their graduation status with a regression model as described in Florida. For Chicago we only have college attendance data for students who graduated from the Chicago public school system, so we also impute college attendance for students with missing graduation data, using the same regression model as for graduation imputation.

III. Results

A. Summary Statistics by Transition Type

Table 1 provides an overview of the number of charters operating in Florida and Chicago, broken down by grade offerings and year. In Florida the number of charters operating grew rapidly, nearly tripling in number over the four years that the sample cohorts would have entered

9th grade. Traditional grade groupings dominate among Florida charter schools; roughly two-thirds of charter schools offer only elementary, middle or high school grades. Like Florida, the charter sector in Chicago experienced rapid growth; the number of charter schools expanded from 10 to 25 over the sample period. Unlike Florida, however, K-12 schools make up a much larger share of charters in Chicago. Nearly one-quarter of all charter schools observed in Chicago offer elementary, middle and high school grades while at most three charter schools offering only high school grades existed during any one year within the period of study.

Summary statistics on student characteristics and educational attainment are provided in Table 2. For each jurisdiction the students are broken down by transition type: charter middle school to traditional public high school and charter middle school to charter high school.[6] The full sample includes over 5,000 students: over 4,200 students from Florida and nearly 1,000 students from Chicago.

The raw data reveal substantial differences in educational attainment between charter and traditional public high school attendees. In Florida, 57 percent of students who went from a charter school in eighth grade to a traditional public school in grade 9 received a standard high school diploma within four years whereas 77 percent of students attending a charter school in grade nine earned their diploma within four years. In Chicago, 68 percent of charter middle school students who transitioned to a traditional public school in grade nine eventually received their high school diploma whereas 75 percent of students who transitioned to a charter high school received their diplomas. Similar differentials are found for college attendance as well. In

[6] Throughout the analysis, exposure to a charter high school is defined by the type of school a student attends in grade 9, whether or not they subsequently stay in that type of school. As illustrated in appendix Table A1, significant numbers of students switch school types (primarily from charters back to traditional public schools) after ninth grade. Excluding these students has little effect on the results, however (see Tables A2 and A3). Nonetheless, the estimates of charter school effects should be interpreted as an "attempt to treat."

Florida, 57 percent of students attending a charter school in grade 9 went to either a two-year or four-year post-secondary institution within five years of starting high school whereas among students who started high school in a traditional public school the college attendance rate was only 40 percent. In Chicago, the gap in college attendance is smaller but still sizable: 49 percent for charter high school attendees and 38 percent for charter middle school students who go to a traditional public high school.

B. Probit Estimates of the Determinants of Educational Attainment

Tables 3 and 4 contain marginal probabilities from probit estimates of the determinants of high school graduation and college attendance, respectively. In both cases the estimation sample includes all public school ninth graders who attended a charter school in grade 8. The sample for college attendance is not conditioned on high school graduation and thus estimates from that model represent the influence of charter high schools on the joint outcome of completing high school and attending college.[7] The estimated models include controls for student demographics, English language skills, special education program participation, family income (proxied by free/reduced-price lunch status) and mobility during middle school.[8] Student ability and prior educational inputs are accounted for by inclusion of eighth grade test scores in math and reading.[9]

---

[7] The smaller size of the college attendance sample, relative to the high school diploma sample, is due to the longer (five year) observation window, which eliminates one cohort of students. In both Florida and Illinois, students may be admitted into community colleges with a GED and thus some college attendees are not recipients of high school diplomas.

[8] English language skills in Florida are measured by participation in a Limited English Proficiency (LEP) program. For Chicago, English language skill is measured by participation in a bilingual program.

[9] In Florida, we use the student's scale scores on the FCAT-SSS test, a criterion-referenced test based on the state's curriculum standards. The Stanford Achievement Test is also administered to students in Florida, but administration

The estimated impact of charter high school attendance on the probability of obtaining a high school diploma is positive in both Florida and Chicago. In Chicago, students who switched from a charter middle school to a charter high school were seven percentage points more likely to earn a regular high school diploma than their counterparts with similar observable characteristics who attended a traditional public high school. The graduation differential for Florida charter schools was even higher at 12 to 15 percentage points, depending on whether a four-year or five-year window for graduation is used. Graduation rates are also positively correlated with eighth grade achievement scores, with a statistically significant relationship in both Florida and Chicago. Females have higher graduation rates than males in both jurisdictions, all else equal. Further, conditional on eighth grade achievement levels as well as other demographic characteristics, blacks have higher graduation rates than whites in both Florida and Chicago. Controlling for language status and family income as well as test scores, Hispanic students are more likely to earn a high school diploma than Anglos, though the result is statistically significant only in Florida.[10]

The findings for college attendance, presented in Table 3, are remarkably similar in Florida and Chicago. A student who attended a charter school in eighth grade and transitioned to a charter high school in grade 9 is 8 to 10 percentage points more likely to attend a post-

---

of the Stanford test did not begin until the 1999/2000 school year. In Chicago, we use the student's scale score on the Iowa Test of Basic Skills, a criterion-referenced test used in Illinois during this period.

[10] While the observed positive correlation between special education status and receipt of a standard high school diploma may appear anomalous, it is not necessarily so. Students with the most profound disabilities are exempted from testing and are thus excluded from our sample. Further, we are conditioning on eighth grade test scores. Our results indicate that *if* a student receiving special education services had the same test score in middle school as a non-disabled student he or she would be more likely to earn a standard high school diploma. However, on average students with disabilities tend to have lower test scores than their typical peers.

secondary institution within 5 years of starting high school than a similar student who attended a traditional public high school.[11]

In the results presented thus far, possible selection bias is mitigated in two ways. First, by including student/family characteristics as explanatory variables we control for observable differences between students who attend charter high schools and those that go to traditional public high schools. Second, by limiting the sample to students who attended a charter school in eighth grade we indirectly control for unobserved student/family traits that may be correlated with charter school attendance. Nonetheless, there still exists the possibility that observed changes occur between eighth and ninth grade that influence both high school choice and subsequent educational attainment. For example, dissatisfaction with performance in a charter middle school that is not captured by test scores (e.g., discipline issues or a poor fit between the student's interests/ability and the curriculum being offered) could lead parents to choose to send their child to a traditional public high school and be correlated with later performance in high school. Depending on the forces behind high school choice this could impart either a negative or a positive bias on the estimated impact of charter high school attendance on educational attainment. To consider this possibility and develop further safeguards against selection bias we next explore the determinants of high school choice.

---

[11] We also estimated the college attendance model using a six-year window. Tracking students six years past eighth grade reduces the number of cohorts and thus attenuates the sample size significantly, particularly in Chicago. Using the six-year window, the effect of charter high school attendance on college attendance remains positive and significant in the Florida sample but is positive and statistically insignificant in the Chicago sample. Using the six-year-window sample in Chicago, but estimating the probability of attending college within five years of eighth grade yields similar results, suggesting the differential effects between the five-year and six-year estimates are due to the reduction in sample size, rather than lengthening the window in which to observe college attendance.

C. Determinants of Charter High School Attendance

As demonstrated by Neal (1997), Grogger and Neal (2000) and Altonji et al. (2005), high school choice is determined in part by physical proximity. In the charter context this can play out in two ways. First, some charter schools offer both middle and high school grades, effectively making the transition cost zero.[12] Second, when a student must switch schools to attend high school distance can vary greatly; the nearest charter high school may either be down the street or many miles away.

Table 5 provides summary statistics on the transition patterns of students based on the range of grades that were offered by the charter school they attended in grade 8. As one would expect, students whose grade 8 school also offered at least some high school grades were much more likely to attend a charter school in grade 9 than were students who had to switch schools in order to continue in a charter in grade 9. In Florida, about 57 percent of students whose charter school offered some or all high school grades went to a charter high school whereas only 20 percent of students whose charter middle school did not offer high school grades continued on to a charter high school. In Chicago, eighth-grade charter students were generally more likely to attend a charter high school, but the relative transition rates based on grade availability are similar to those in Florida. In Chicago 74 percent of students whose eighth grade charter offered grade 9 attended a charter school in grade 9 whereas the proportion of students who had to go to a different school in grade 9 and chose to attend a charter school was only 25 percent. Clearly the ability to remain in the same school has a large impact on high school choice.

[12] While most charters schools offering middle and high school classes have all grades in the same location, this is not universal. In a few instances there can be one common administration but the high school campus may be physically separate from the middle school campus.

We can also measure the physical proximity of other charter high schools and thereby gauge the effect of distance on high school choice. Further, in Florida we can determine the proximity of traditional public high schools. Table 6 provides information on the number of traditional public and charter school options available to Florida students within 10, 5 and 2.5 miles of the charter school they attended in grade 8. As expected, students who go on to a charter school in grade 9 have fewer traditional public school options and more charter schools to choose from within a given distance than do students who transition to traditional public schools.

In Table 7 we present probit estimates of the choice of attending a charter school in grade 9 as a function of both the grade offerings of a student's middle school and the availability of other school alternatives. Consistent with the summary statistics presented in Table 5, the availability of ninth grade in the same school a student attended in eighth grade has the largest impact on the likelihood of attending a charter school in grade 9, raising the probability from 18 to 46 percentage points, depending on the jurisdiction and the size of the geographic area under consideration. The number of other charter schools offering grade 9 always carries a positive coefficient, though the effect is only significant for the 5-mile radius in Chicago.[13] Within Florida, the availability of a traditional public high school within either 2.5 miles or 5 miles of the student's middle school has a significant negative correlation with charter high school attendance, as one would expect if the two are substitutes. Holding constant the number of charter schools within a given area, distance to the nearest charter high school appears to affect

[13] The fact that high school choice is not significantly affected by having additional charter high school options nearby suggests that the diversity among charter high schools may be less than the difference between charters and traditional public high schools.

school choice as well.[14] For both the 2.5-mile and 5-mile radii, distance to other charter schools offering grade 9 is negatively correlated with charter attendance in ninth grade in Florida, as one would expect. For example, using the 5-mile radius, having a charter high school 1 mile away from a student's middle school rather than 5 miles away would increase the probability of attending a charter school in ninth grade by 1.6 percentage points. Perhaps due to the urban setting, distance to other charter schools is not a significant factor in Chicago.

D. Bivariate Probit Estimates of the Determinants of Educational Attainment

Bivariate probit regressions of educational attainment are presented in Tables 8 and 9.[15] For the charter high school attendance equation we use the 2.5-mile radius specification from Table 7 for both Florida and Chicago, since it provided the best fit. However, we obtain very similar results if we instead use the 5-mile radius specification. The attainment equations are the same as those estimated by single-equation probit analysis in Tables 3 and 4. We continue to find highly significant positive correlations between charter high school attendance and both receipt of a high school diploma and college attendance. The magnitude of the effects are quite large, roughly double the size of the estimates from the single-equation probit.

The larger estimated coefficients in the bivariate probit model as well as the negative estimated cross-equation correlations (rho) suggest a negative selection bias. To the extent there is self-selection, it is the students who are less likely to graduate (conditional on observed

[14] In Florida, if the distance to the nearest school of a given type exceeded 25 miles the minimum distance measure was assigned a value of 99.

[15] The bivariate probit allows the unobserved determinants of high school choice and educational attainment are correlated by assuming that the errors from the high school choice and high school graduation or college attendance models are distributed bivariate normal. See Evans and Schwab (1995).

characteristics) who are choosing to attend charter high schools.[16] We can only speculate as to why this is so. It is possible that parents whose children are at risk of dropping out are more likely to choose charter high schools in a belief that the traditional public school environment would make it more likely that their child leaves school early. Alternatively, although we control for free/reduced-price lunch eligibility, it may be the case that low-income families have a stronger preference for charter schools which leads them to place their children in charter high schools but also makes it less likely that they will be able to afford to send their children to college.

E. Robustness Checks

As described above, graduation indicators (and college attendance in Chicago) were imputed for students whose graduation status could not be directly determined because they left the public schools or moved out of the jurisdiction. This was done to avoid potential attrition bias. We show in Tables 10 and 11, however, simply dropping students whose educational attainment is unknown and not imputing any values yields qualitatively similar results. In all cases the charter school effects are still positive and statistically significant.

Given that charter high schools tend to be much smaller than traditional public high schools, school size and charter status may be confounded in our baseline analysis. Put differently, what appear to be charter school effects could simply be school size effects. In order to disentangle the effects of school size and school type on educational attainment we re-estimated the high school graduation and college attendance models with an additional control

[16] Interestingly, Neal (1997), as well as other papers in the Catholic high school literature he cites, also finds a negative selection effect. Neal conjectures that affluent parents with strong preferences for educational quality are more likely to live in suburban areas with elite public schools and thus Catholic high schools may not attract students with the best (unobserved) traits.

for the total number of students attending the school. The results, presented in the third panel of Tables 10 and 11, are comparable to those from the baseline model, indicating the estimated charter high school differentials are not due to differences in school size.

We attempt to distinguish between pure achievement effects and educational attainment effects of charters by including controls for 10th grade math and reading achievement scores. As indicated by the estimates reported in the fourth panel of Tables 10 and 11, controlling for 10th grade test scores reduces by half the charter high school graduation differential in Florida but lowers the estimated charter high school effects by less than 20 percent in Chicago. Controlling for 10th grade test scores has an even smaller effect on the estimated impact of charter high school attendance on college enrollment, altering the estimated magnitude by only about 10 percent in both Florida and Chicago. Sample sizes are reduced when including 10th grade test score information, so the reduction in the estimated effects of charter school attendance could simply be due to attrition. Nevertheless, are findings suggest that the differential effects of charter schools on educational attainment are not due solely to measured achievement differences in charter and traditional public high schools.[17]

In the traditional public school sector in both Chicago and Florida, high schools are almost always separate from middle schools. This is not the case for charter schools, however. As noted in Table 1, in 2001/02 18 of 82 or about 22 percent of charter schools in Florida offering middle-school grades also offered some or all high school grades. In contrast, in Chicago 6 of 15 or 40 percent of charter schools offered both middle and high school grades. As a result, as reported in Table 5, about 30 percent of Florida charter 8th-grade students attended

[17] We also separately estimated the relationship between charter high school attendance and student achievement. Results are reported in Tables A4 and A5. While 10th grade scores are positively correlated with charter attendance in Chicago, that is not the case in Florida.

schools that also offered at least some high-school grades. In Chicago, nearly half of the 8th-grade charter school students could attend at least some high school grades (grades 9-12) without changing schools. Indeed, over 70 percent of the Chicago students who attended charter schools in both grades 8 and 9 were in schools offering both middle-school and high school grades. This raises the concern that the measured effects of charter high school attendance on educational attainment could simply reflect advantages of grouping middle and high school grades together rather than differences in curriculum, organization or employment practices between charters and traditional public schools.

In order to disentangle grade configuration effects from pure charter school effects, we restricted the Florida sample to those students whose 8th-grade charter school did not offer grade nine and re-estimated both the simple probit and bivariate probit models of high school graduation and college attendance.[18] The resulting estimates are presented in the fifth panel of Table 10. For high school graduation, restricting the sample produces estimates of the univariate probit model that are nearly identical to the original estimates. In the bivariate probit model using the restricted sample the estimates are about 30 percent smaller than when using the full sample. In both the univariate and bivariate models of high school graduation the restricted-sample estimates of charter high school attendance are statistically significant at very high confidence levels. In contrast, estimates of the effect of charter high school attendance on college enrollment are higher in the restricted sample compared to the original sample that includes schools offering both eighth and ninth grade. As with the high school graduation estimates, the estimated coefficients on the charter high school variables in the college

[18] Since schools offering grade 9 are removed from the sample, the first stage of the bivariate probit excludes the "Eighth Grade Charter Offers Grade 9" variable.

enrollment models remain statistically significant at better than 95 percent confidence levels. These findings suggest that while combining middle and high school grades may enhance the likelihood of high school graduation (at least in the charter sector), the positive association between charter high school attendance and educational attainment is not primarily due to differences in grade configurations between charters and traditional public schools.

Another potential concern is that a number of charter schools in Florida are former traditional public schools that converted to charter status. If conversion schools were better-than-average traditional public schools to begin with, they may be distorting the estimated impact of charters on educational attainment. In order to allow for a differential impact of conversion charters we added a conversion charter interaction term and re-estimated the graduation and college attendance equations. As indicated in the last panel of Table 10, conversion charters have significantly greater effects on high school graduation than do de-novo charters, though the impact of non-conversion charters is still sizable in magnitude (nearly equal to the estimate in Chicago) and significant at better than a 95 percent confidence level. For college attendance, we observe no significant differential impact of attending a conversion charter and the correlation between attending a de-novo charter and college attendance is still positive and significant at better than a 95 percent confidence level.

IV. Summary and Conclusions

While a number of recent studies analyze the relationship between charter school attendance and student achievement, this is the first analysis of the impacts on educational attainment of charter school attendance. Like student achievement analysis, the study of educational attainment in charters is problematic due to the self-selection of students into charter schools. We deal with the selection problem by controlling for numerous observable student

characteristics, restricting the sample to students who attended a charter middle school, and employing high school proximity measures as exogenous instruments.

Applying these methods, we find that charter schools are associated with a higher probability of successful high school completion and an increased likelihood of attending a two-year or a four-year college in two disparate jurisdictions, Florida and Chicago. The reasons for these differentials are not clear. We show that they are not driven by the smaller size of charter schools and are only partially explained by achievement differences between charters and traditional public schools. There is certainly room for future work to explore curricular differences, differences in expectations engendered by different environments and other factors that may cause charter schools to diminish the high-school dropout rate and promote post-secondary schooling.

Our findings are consistent with recent work on the efficacy of Catholic schools, which finds large positive effects of Catholic high school attendance on educational attainment. While just a first step, the results presented here and in the Catholic school literature suggest that expanding school choice at the high school level may be a part of an effective policy to reduce high school dropout rates and to promote college attendance.

References

Altonji, Joeseph G., Todd E. Elder and Christopher R. Taber, "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *Journal of Political Economy* 113 (2005):151-184.

Ballou, Dale, Bettie Teasley, and Tim Zeidner, "A Comparison of Charter Schools and Traditional Public Schools in Idaho," working paper, Vanderbilt University, 2006.

Bifulco, Robert and Helen F. Ladd, "The Impacts of Charter Schools on Student Achievement: Evidence from North Carolina," *Education Finance and Policy* 1 (2006):50–90.

Booker, Kevin, Scott M. Gilpatric, Timothy Gronberg and Dennis Jansen, "The Impact of Charter School Attendance on Student Performance," *Journal of Public Economics* 91 (2007):849-876.

Evans, William N. and Robert M. Schwab, "Finishing High School and Starting College: Do Catholic Schools Make a Difference?" *Quarterly Journal of Economics*, 110 (1995): 941-974.

Grogger, Jeffrey, and Derek Neal, "Further Evidence on the Effects of Catholic Secondary Schooling," *Brookings-Wharton Papers on Urban Affairs*, 2000 (2000):151-201.

Hanushek, Eric A., John F. Kain, Steven G. Rivkin, and Gregory F. Branch, "Charter School Quality and Parental Decision Making with School Choice," Working paper no. 11252. Cambridge, MA: National Bureau of Economic Research, 2005.

Hoxby, Caroline M., and Sonali Murarka, "The Effects of New York City's Charter Schools on Student Achievement," working paper, Harvard University, 2007.

Hoxby, Caroline M., and Jonah E. Rockoff, "The Impact of Charter Schools on Student Achievement," working paper, Harvard University, 2004.

Imberman, Scott A., "Achievement and Behavior in Charter Schools: Drawing a More Complete Picture," working paper, University of Houston, 2007.

Neal, Derek, "The Effects of Catholic Secondary Schooling on Educational Achievement", *Journal of Labor Economics*, 15 (1997):98-123.

Sander, William, and Anthony C. Krautman, "Catholic Schools, Dropout Rates and Educational Attainment," *Economic Inquiry*, 33 (1995):217-233.

Sass, Tim R., "Charter Schools and Student Achievement in Florida," *Education Finance and Policy* 1 (2006):91–122.

Solmon, Lewis C. and Pete Goldschmidt, "Comparison of Traditional Public Schools and Charter Schools on Retention, School Switching, and Achievement Growth," Phoenix, AZ: The Goldwater Institute, 2004.

Solmon, Lewis, Kern Paark and David Garcia, "Does Charter School Attendance Improve Test Scores? The Arizona Results," Phoenix, AZ: The Goldwater Institute, 2001.

Zimmer, Ron, and Richard Buddin, "Charter School Performance in Two Large Urban Districts", *Journal of Urban Economics*, 60 (2006):307-326.

Table 1 - Number of Charter Schools in Operation by Grade Range and Year

	Florida				Chicago				
Grade Offerings	1998/99	1999/00	2000/01	2001/02	1998/99	1999/00	2000/01	2001/02	2002/03
Elementary Only	25	37	52	68	2	2	11	9	7
Elementary, Middle and H.S. Grades	2	5	4	8	2	2	6	6	6
Elementary and Middle Grades	15	21	35	40	1	2	7	9	11
Middle Grades Only	12	20	23	24	1	1	0	0	0
Middle and Some H.S. Grades	2	4	1	3	1	0	0	0	0
Middle and All H.S. Grades	6	5	6	7	1	2	0	0	0
Only H.S. Grades	5	13	20	26	2	3	1	1	1
Total	67	105	141	176	10	12	25	25	25

Note: number of charter schools and grade ranges based on student membership counts.

Table 2 – Descriptive Statistics by Transition Type

	Florida				Chicago			
	Charter in G8, Traditional in G9		Charter in G8, Charter in G9		Charter in G8, Traditional in G9		Charter in G8, Charter in G9	
	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
Any College in 5	1526	0.402	572	0.556	295	0.383	299	0.488
4-Yr College in 5	1523	0.148	570	0.305				
HS Diploma in 4	2149	0.571	1066	0.795				
HS Diploma in 4 (with imputation)	2762	0.567	1259	0.770				
HS Diploma in 5	1123	0.568	460	0.783				
HS Diploma in 5 (with imputation)	1445	0.566	551	0.764				
HS Diploma Ever					456	0.678	381	0.753
HS Diploma Ever (with imputation)					523	0.597	474	0.636
Math Score, G8	2831	291.258	1293	310.083	517	246.342	471	236.896
Reading Score, G8	2818	283.195	1283	300.984	515	240.309	471	232.406
Female	2914	0.467	1304	0.486	523	0.53	474	0.563
Black	2893	0.370	1295	0.178	523	0.834	474	0.835
Hispanic	2893	0.106	1295	0.189	523	0.132	474	0.143
Asian	2893	0.010	1295	0.017	523	0.002	474	0
LEP/Bi-Lingual in G8	2914	0.009	1304	0.023	523	0.082	474	0.093
Special Ed in G8	2914	0.152	1304	0.103	523	0.134	474	0.108
Free/R-P Lunch in G8	2914	0.411	1304	0.225	463	0.896	395	0.896
Change Schools in G7-8	2663	0.674	1175	0.716	523	0.264	474	0.272
1997 G8 Cohort	2914	0.027	1304	0.001				
1998 G8 Cohort	2914	0.115	1304	0.102	523	0.061	474	0.114
1999 G8 Cohort	2914	0.382	1304	0.336	523	0.153	474	0.19
2000 G8 Cohort	2914	0.476	1304	0.561	523	0.203	474	0.177
2001 G8 Cohort					523	0.231	474	0.306
2002 G8 Cohort					523	0.352	474	0.213

Table 3 - Probit Estimates of Receiving a Standard High School Diploma (Coefficient Estimates are Marginal Effects)

	Florida		Chicago
	Within 4 Years	Within 5 Years	Within 5+ Years
Attend Charter H.S.	0.1223**	0.1481**	0.0741*
	(0.0318)	(0.0375)	(0.0376)
Math Score, Grade 8	0.0033**	0.0034**	0.0016*
	(0.0003)	(0.0004)	(0.0008)
Reading Score, Grade 8	0.0021**	0.0018**	0.0023**
	(0.0002)	(0.0003)	(0.0007)
Female	0.0678**	0.0474+	0.0682*
	(0.0159)	(0.0268)	(0.0331)
Black	0.0559**	0.1062**	0.1961*
	(0.0202)	(0.0329)	(0.0928)
Hispanic	0.0912**	0.1184*	0.0875
	(0.0275)	(0.0445)	(0.1080)
Asian	0.0993	0.1446	
	(0.0864)	(0.1100)	
LEP/Bilingual, Grade 8	0.0628	0.1192	-0.0070
	(0.0956)	(0.1345)	(0.0890)
Special Ed., Grade 8	0.0931**	0.0792*	0.0846+
	(0.0309)	(0.0379)	(0.0450)
Free/Reduced-Price Lunch, Grade 8	-0.1718**	-0.1300**	-0.0292
	(0.0240)	(0.0329)	(0.0636)
Changed Schools, Grade 7 or Grade 8	-0.0744**	-0.0165	-0.0480
	(0.0249)	(0.0365)	(0.0380)
Observations	3642	1784	978

Note: All models include a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table 4 - Probit Estimates of Attending a Two-Year or Four-Year College Within 5 Years (Coefficient Estimates are Marginal Effects)

	Florida	Chicago
Attend Charter H.S.	0.0824**	0.1028*
	(0.0289)	(0.0509)
Math Score, Grade 8	0.0013**	0.0017*
	(0.0005)	(0.0010)
Reading Score, Grade 8	0.0024**	0.0028**
	(0.0004)	(0.0008)
Female	0.0867**	0.0696*
	(0.0299)	(0.0317)
Black	0.0641+	0.1651+
	(0.0371)	(0.0801)
Hispanic	0.1804**	-0.0314
	(0.0533)	(0.1146)
Asian	0.2895*	
	(0.1044)	
LEP/Bilingual, Grade 8	-0.2880*	0.1474+
	(0.0855)	(0.0836)
Special Ed., Grade 8	0.0420	-0.0290
	(0.0432)	(0.0660)
Free/Reduced-Price Lunch, Grade 8	-0.1577**	-0.0130
	(0.0259)	(0.0716)
Changed Schools, Grade 7 or Grade 8	-0.0471	-0.0705
	(0.0314)	(0.0417)
Observations	1787	695

Note: All models include a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table 5 - Student Transitions by Grade Range of Charter School Attended in Grade 8

	Florida			Chicago		
Grade Offerings	To Traditional	To Charter	All	To Traditional	To Charter	All
Middle and No H.S. Grades	2,335 (79.72)	594 (20.28)	2,929 (100.00)	380 (74.66)	129 (25.34)	509 (100.00)
Middle and Some H.S. Grades	169 (41.73)	236 (58.27)	405 (100.00)	26 (92.86)	2 (7.14)	28 (100.00)
Middle and All H.S. Grades	366 (43.99)	466 (56.01)	832 (100.00)	117 (25.43)	343 (74.57)	460 (100.00)
Total	2,870 (68.89)	1,296 (31.11)	4,166 (100.00)	523 (52.46)	474 (47.54)	997 (100.00)

Note: row percentages are in parentheses.

Table 6 -Mean Number of Schools Offering Grade 9 By Student Transition Type (Based on Location of Charter School Student Attended in Grade 8 and Location of Schools Offering Grade 9 in Year After 8th Grade Attendance)

	Florida			
	To Traditional		To Charter	
Variable	Obs.	Mean	Obs.	Mean
Number Of Traditional Public Schools Within 10 Miles Offering Grade 9	2912	22.29	1304	20.87
Charter Student Attended in 8th Grade Offers Grade 9 Within 10 Miles	2912	0.51	1304	0.84
Number of Other Charter Schools Within 10 Miles Offering Grade 9	2912	2.11	1304	3.34
Number Of Traditional Public Schools Within 5 Miles Offering Grade 9	2912	8.56	1304	6.09
Charter Student Attended in 8th Grade Offers Grade 9 Within 5 Miles	2912	0.50	1304	0.80
Number of Other Charter Schools Within 5 Miles Offering Grade 9	2912	1.12	1304	2.19
Number Of Traditional Public Schools Within 2.5 Miles Offering Grade 9	2912	3.47	1304	1.76
Charter Student Attended in 8th Grade Offers Grade 9 Within 2.5 Miles	2912	0.50	1304	0.80
Number of Other Charter Schools Within 2.5 Miles Offering Grade 9	2912	0.60	1304	1.04

Table 7 -Probit Estimates of Attending a Charter High School in Grade 9, Based on Minimum Distance and Number of Schools of Given Type in Surrounding Area Offering Grade 9 in Relevant Year (Coefficient Estimates are Marginal Effects)

	Florida			Chicago	
	10 mi.	5 mi.	2.5 mi.	5 mi.	2.5 mi.
Distance to Nearest Traditional Public School	0.0374 (0.0386)	0.0192 (0.0260)	-0.0026 (0.0230)		
Distance to Nearest Other Charter	-0.0048 (0.0032)	-0.0043+ (0.0025)	-0.0041+ (0.0023)	0.0371 (0.0441)	0.0378 (0.0655)
Number of Traditional Public Schools	-0.0057 (0.0037)	-0.0198* (0.0097)	-0.0680** (0.0266)		
Number of Other Charters	0.0252 (0.0276)	0.0418 (0.0373)	0.0154 (0.0517)	0.1161+ (0.0704)	0.2825 (0.3565)
8th Grade Charter Offers Grade 9	0.2462** (0.0820)	0.1833* (0.0810)	0.1763* (0.0897)	0.4616** (0.1093)	0.4110+ (0.1988)
Observations	4216	4216	4216	978	978
Psuedo R-squared	0.18	0.20	0.22	0.22	0.22

Note: Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table 8 - Bivariate Probit Estimates of Receiving a Standard High School Diploma (Coefficient Estimates are Marginal Effects)

	Florida		Chicago
	Within 4 Years	Within 5 Years	Within 5+ Yrs
Attend Charter H.S.	0.3117**	0.3298**	0.1481**
	(0.0546)	(0.0645)	(0.0487)
Math Score, Grade 8	0.0030**	0.0030**	0.0008*
	(0.0003)	(0.0005)	(0.0004)
Reading Score, Grade 8	0.0019**	0.0018**	0.0010**
	(0.0003)	(0.0003)	(0.0003)
Female	0.0655**	0.0445+	0.0319*
	(0.0159)	(0.0263)	(0.0162)
Black	0.0846**	0.1340**	0.0917*
	(0.0245)	(0.0364)	(0.0382)
Hispanic	0.0841**	0.1187**	0.0321
	(0.0299)	(0.0461)	(0.0515)
Asian	0.0908	0.0766	
	(0.0939)	(0.1411)	
LEP, Grade 8	0.0708	0.1199	0.0170
	(0.0918)	(0.1434)	(0.0440)
Special Ed., Grade 8	0.0806*	0.0711+	0.0380*
	(0.0329)	(0.0366)	(0.0223)
Free/Reduced-Price Lunch, Grade 8	-0.1545**	-0.1099**	-0.0120
	(0.0224)	(0.0329)	(0.0289)
Changed Schools, Grade 7 or Grade 8	-0.0634**	-0.0043	-0.0164
	(0.0212)	(0.0300)	(0.0158)
Rho	-0.4632**	-0.5303**	-0.4919**
	(0.1228)	(0.1320)	(0.1932)
Observations	3640	1783	978

Note: All models include a set of cohort indicators. Standard errors, which equal the marginal effects divided by the bivariate probit z-scores (adjusted for clustering at the school level), are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%. The 2.5-mile-radius equation reported in Table 7 is used to predict charter high school attendance.

Table 9 - Bivariate Probit Estimates of Attending a Two-Year or Four-Year College Within 5 Years
(Coefficient Estimates are Marginal Effects)

	Florida	Chicago
Attend Charter H.S.	0.1763+	0.1405**
	(0.1063)	(0.0394)
Math Score, Grade 8	0.0012**	0.0006
	(0.0005)	(0.0005)
Reading Score, Grade 8	0.0024**	0.0011*
	(0.0004)	(0.0005)
Female	0.0863**	0.0299+
	(0.0296)	(0.0174)
Black	0.0748+	0.0778**
	(0.0399)	(0.0297)
Hispanic	0.1862**	-0.0020
	(0.0513)	(0.0452)
Asian	0.2728*	
	(0.1266)	
LEP/Bilingual, Grade 8	-0.2858*	0.0848+
	(0.1153)	(0.0456)
Special Ed., Grade 8	0.0410	-0.0162
	(0.0429)	(0.0292)
Free/Reduced-Price Lunch, Grade 8	-0.1498**	-0.0134
	(0.0279)	(0.0329)
Changed Schools, Grade 7 or Grade 8	-0.0411	-0.0209
	(0.0295)	(0.0222)
Rho	-0.2052	-0.4855+
	(0.1884)	(0.2491)
Observations	1786	695

Note: All models include a set of cohort indicators. Standard errors, which equal the marginal effects divided by the bivariate probit z-scores (adjusted for clustering at the school level), are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%. The 2.5-mile-radius equation reported in Table 8 is used to predict charter high school attendance.

Table 10 – Probit and Bivariate Probit Estimates of the Relationship Between Charter High School Attendance and Educational Attainment in Florida from Alternative Samples and Models (Coefficient Estimates are Marginal Effects)

	H.S. Diploma Within 4 Years		Attend College Within 5 Years	
	Probit	Bivariate Probit	Probit	Bivariate Probit
Baseline Model (Full Sample)				
Attend Charter H.S.	0.1223**	0.3117**	0.0824*	0.1763+
	(0.0318)	(0.0546)	(0.0289)	(0.1063)
Baseline Model (Without imputing missing values)				
Attend Charter H.S.	0.1500**	0.3319**	0.0824**	0.1763+
	(0.0335)	(0.0607)	(0.0289)	(0.1063)
Model With Controls for School Size (Full Sample)				
Attend Charter H.S.	0.1720**	0.3292**	0.1086**	0.1807+
	(0.0312)	(0.0543)	(0.0333)	(0.1027)
Model With Controls for 10th Grade Test Score (Full Sample)				
Attend Charter H.S.	0.0468+	0.1153**	0.0900*	0.1423+
	(0.0227)	(0.0404)	(0.0385)	(0.0838)
Baseline Model (Only Students Whose 8th Grade Charter Does Not Offer Grade 9)				
Attend Charter H.S.	0.1257**	0.2205**	0.1074*	0.2985**
	(0.0376)	(0.0674)	(0.0424)	(0.1092)
Model Allowing Differential Effect of Conversion Charter High Schools (Full Sample)				
Attend Charter H.S.	0.0811*	0.2825**	0.0898*	0.2031*
	(0.0315)	(0.0616)	(0.0358)	(0.1033)
Attend Charter H.S.	0.1451**	0.0801**	-0.0215	-0.0510
× Conversion Charter	(0.0321)	(0.0311)	(0.0421)	(0.0550)

Note: All models include the explanatory variables delineated in Table 3 and a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table 11 – Probit and Bivariate Probit Estimates of the Relationship Between Charter High School Attendance and Educational Attainment in Chicago from Alternative Samples and Models (Coefficient Estimates are Marginal Effects)

	H.S. Diploma		Attend College Within 5 Years	
	Probit	Bivariate Probit	Probit	Bivariate Probit
Baseline Model (Full Sample)				
Attend Charter H.S.	0.0741*	0.1481**	0.1028*	0.1405**
	(0.0347)	(0.0487)	(0.0509)	(0.0394)
Baseline Model (Without imputing missing values)				
Attend Charter H.S.	0.1076**	0.1539**	0.1302*	0.1479**
	(0.0384)	(0.0595)	(0.0608)	(0.0506)
Model With Controls for School Size (Full Sample)				
Attend Charter H.S.	0.0588+	0.1438**	0.0699+	0.1300**
	(0.0334)	(0.0464)	(0.0404)	(0.0329)
Model With Controls for 10th Grade Test Score (Full Sample)				
Attend Charter H.S.	0.0609+	0.1410**	0.0924+	0.1289**
	(0.0338)	(0.0512)	(0.0507)	(0.0421)

Note: All models include the explanatory variables delineated in Table 3 and a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table A1 – 10th Grade Location by Type of Transition Between 8th and 9th Grade

	Florida				Chicago			
	To Traditional		To Charter		To Traditional		To Charter	
Variable	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean
Enrolled in Traditional Public School in Grade 10	2084	0.962	1144	0.167	425	0.984	408	0.177
Enrolled in Charter School in Grade 10	2084	0.038	1144	0.833	425	0.016	408	0.823

Table A2 -Probit Estimates of Receiving a Standard High School Diploma (Coefficient Estimates are Marginal Effects) -- Sample Restricted to Students Who Were in the Same Type of School (Traditional or Charter) in Both 9th and 10th Grade

	Florida		Chicago
	Within 4 Years	Within 5 Years	Within 5+ Years
Attend Charter H.S.	0.1253**	0.1472**	0.0535
	(0.0320)	(0.0379)	(0.0324)
Math Score, Grade 8	0.0033**	0.0036**	0.0007
	(0.0003)	(0.0005)	(0.0008)
Reading Score, Grade 8	0.0020**	0.0017**	0.0022**
	(0.0003)	(0.0003)	(0.0006)
Female	0.0604**	0.0386	0.0874**
	(0.0165)	(0.0286)	(0.0331)
Black	0.0416*	0.0908**	0.0180
	(0.0199)	(0.0324)	(0.1069)
Hispanic	0.0972**	0.1132*	-0.0902
	(0.0282)	(0.0441)	(0.1476)
Asian	0.0833	0.1286	
	(0.0894)	(0.1154)	
LEP/Bilingual, Grade 8	0.0491	0.0327	0.0318
	(0.0918)	(0.1554)	(0.0817)
Special Ed., Grade 8	0.0955**	0.0929*	0.0514
	(0.0314)	(0.0394)	(0.0440)
Free/Reduced-Price Lunch, Grade 8	-0.1660**	-0.1216**	0.0150
	(0.0254)	(0.0339)	(0.0524)
Changed Schools, Grade 7 or Grade 8	-0.0703**	-0.0115	-0.0475
	(0.0259)	(0.0373)	(0.0343)
Observations	3410	1686	741

Note: All models include a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table A3 -Probit Estimates of Attending a Two-Year or Four-Year College Within 5 Years (Coefficient Estimates are Marginal Effects) -- Sample Restricted to Students Who Were in the Same Type of School (Traditional or Charter) in Both 9th and 10th Grade

	Florida	Chicago
Attend Charter H.S.	0.0899**	0.1007
	(0.0295)	(0.0621)
Math Score, Grade 8	0.0012**	0.0022
	(0.0005)	(0.0014)
Reading Score, Grade 8	0.0024**	0.0026*
	(0.0004)	(0.0010)
Female	0.0917**	0.1156*
	(0.0298)	(0.0425)
Black	0.0527	0.0446
	(0.0378)	(0.1397)
Hispanic	0.1801**	-0.1932
	(0.0544)	(0.1295)
Asian	0.2727*	
	(0.1029)	
LEP/Bilingual, Grade 8	-0.2907*	0.1899*
	(0.0865)	(0.0964)
Special Ed., Grade 8	0.0445	-0.0703
	(0.0459)	(0.0756)
Free/Reduced-Price Lunch, Grade 8	-0.1504**	0.0215
	(0.0262)	(0.0826)
Changed Schools, Grade 7 or Grade 8	-0.0427	-0.0172
	(0.0319)	(0.0541)
Observations	1688	509

Note: All models include a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table A4 –OLS Estimates of the Determinants of 10th Grade Achievement Test Scores

	Florida		Chicago	
	Math	Reading	Math	Reading
Attend Charter H.S.	-3.0140+	1.9708	0.2743+	0.5533*
	(1.7176)	(1.8656)	(0.1478)	(0.2191)
Math Score, Grade 8	0.6502**		0.0791**	
	(0.0205)		(0.0038)	
Reading Score, Grade 8		0.6508**		0.0969**
		(0.0206)		(0.0047)
Female	-5.6823**	-0.6120	-0.0842	0.4754*
	(0.8848)	(1.2690)	(0.0946)	(0.1951)
Black	-9.0295**	-9.5340**	-1.1637+	-1.6731*
	(1.7447)	(1.6819)	(0.6078)	(0.7792)
Hispanic	0.1169	-0.4565	-0.4299	-0.7337
	(1.3359)	(1.5311)	(0.6537)	(0.8574)
Asian	3.1367	-7.8507*	0.6942	-2.6232**
	(3.1829)	(3.9892)	(0.6148)	(0.7854)
LEP/Bilingual, Grade 8	-1.5450	1.6469	-0.4468	-0.7117
	(2.4511)	(11.3321)	(0.2847)	(0.6484)
Special Ed., Grade 8	-6.4861*	-11.3290**	0.3093	-0.4412
	(2.6886)	(2.9600)	(0.2149)	(0.3454)
Free/Reduced-Price Lunch, Grade 8	-3.4854*	-4.4255**	-0.7776**	-0.2601
	(1.4957)	(1.5441)	(0.2581)	(0.3533)
Changed Schools, Grade 7 or Grade 8	-1.0068	0.5110	-0.2789+	-0.0908
	(1.1078)	(1.3150)	(0.1638)	(0.1943)
R-squared	0.712	0.601	0.550	0.485
Observations	2465	2471	978	978

Note: All models include a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table A5 –2SLS Estimates of the Determinants of 10th Grade Achievement Test Scores

	Florida		Chicago	
	Math	Reading	Math	Reading
Attend Charter H.S.	1.0020 (3.1050)	1.9657 (2.8143)	0.7806** (0.2708)	0.4873 (0.4687)
Math Score, Grade 8	0.6493** (0.0205)		0.0807** (0.0043)	
Reading Score, Grade 8		0.6508** (0.0205)		0.0968** (0.0048)
Female	-5.6529** (0.8747)	-0.6200 (1.2656)	-0.1091 (0.0998)	0.4789* (0.1969)
Black	-8.6800** (1.7814)	-9.5134** (1.6507)	-1.1813+ (0.6498)	-1.6694* (0.7842)
Hispanic	-0.1882 (1.4034)	-0.4592 (1.5240)	-0.4824 (0.6761)	-0.7277 (0.8591)
Asian	2.8318 (3.3794)	-7.8449* (3.9589)	0.9546 (0.6579)	-2.6561** (0.8192)
LEP/Bilingual, Grade 8	-1.5323 (2.5704)	1.6382 (11.2726)	-0.4474 (0.2811)	-0.7112 (0.6473)
Special Ed., Grade 8	-6.1555* (2.6784)	-11.2703** (2.9565)	0.3861+ (0.2105)	-0.4495 (0.3661)
Free/Reduced-Price Lunch, Grade 8	-2.9132* (1.5068)	-4.4142** (1.4347)	-0.7649** (0.2665)	-0.2617 (0.3506)
Changed Schools, Grade 7 or Grade 8	-1.3260 (1.4901)	0.5247 (1.3708)	-0.2937+ (0.1604)	-0.0900 (0.1920)
R-squared	0.710	0.600	0.544	0.484
Observations	2464	2470	978	978

Note: All models include a set of cohort indicators. Standard errors adjusted for clustering at the school level are in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.